

Parameter Validation for Evaluation of Spaceflight Hardware Reusability

Within recent years, there has been an influx of companies around the world pursuing reusable systems for space flight. Much like NASA, many of these new entrants are learning that reusable systems are complex and difficult to achieve. For instance, in its first attempts to retrieve spaceflight hardware for future reuse, SpaceX unsuccessfully tried to land on a barge at sea, resulting in a crash-landing. As this new generation of launch developers continues to develop concepts for reusable systems, having a systematic approach for determining the most effective systems for reuse is paramount. Three factors that influence the effective implementation of reusability are cost, operability and reliability. Therefore, a method that integrates these factors into the decision-making process must be utilized to adequately determine whether hardware used in space flight should be reused or discarded.

Previous research has identified seven features that contribute to the successful implementation of reusability for space flight applications, defined reusability for space flight applications, highlighted the importance of reusability, and presented areas that hinder successful implementation of reusability. The next step is to ensure that the list of reusability parameters previously identified is comprehensive, and any duplication is either removed or consolidated. The characteristics to judge the seven features as good indicators for successful reuse are identified and then assessed using multiattribute decision making. Next, discriminators in the form of metrics or descriptors are assigned to each parameter. This paper explains the approach used to evaluate these parameters, define the Measures of Effectiveness (MOE) for reusability, and quantify these parameters. Using the MOEs, each parameter is assessed for its contribution to the reusability of the hardware. Potential data sources needed to validate the approach will be identified.